

Case Study No. 17 Waterborne Coatings
The Pine-Tique Furniture Company
Minnetonka, MN

Background

The Pine-Tique Furniture Company was founded in 1973 and originally produced only Early American style pine furniture. Today, they have expanded to include more styles and many wood species. The catalogue currently contains over 125 pieces, and Pine-Tique also manufactures custom designs. There are 25 employees on two shifts. The finishing department includes eight full-time and two part-time employees. Pine-Tique finishes an annual total of about 148,000 board feet. They began testing waterborne coatings in 1996. In 1998, approximately half of their production was finished with a waterborne system; the rest was finished with a solvent-borne system.

Reasons for Conversion

In 1995, it was obvious to the management at Pine-Tique that an expansion of their production capacity was necessary to keep up with growing customer demand. However, the decision also was made that, if possible, the expansion would occur without increasing VOC/HAP emissions. This decision prompted research into currently available alternative coatings. In 1996, Pine-Tique began the process of testing waterborne coatings with the assistance of the Minnesota Technical Assistance Program and the Minnesota Pollution Control Agency.

New Designs

A new finishing area was designed and built to accommodate the projected increase in production. The new finishing area would consist of two sanding and two spraying work stations. The sanding stations provide the prep-sanding before finishes are applied and sealer sanding between coats. Sanding is done by hand with random orbital disc sanders and fine grit paper to minimize grain raise. All sanders are attached to a central dust collection system to trap particulate matter. The sanding stations also are used for attaching final hardware.



Carts provide easy movement between stations

Operator convenience and comfort was the primary concern when designing the new work stations. All furniture is placed on wheeled carts to allow easy movement from one station to another. Each of the four stations is equipped with a custom-designed, built-in floor lift that allows the operator to

lock and lift the various sized furniture carts to the desired height and rotate the pieces 360 degrees while finishing. This configuration is much easier on the operators and allows Pine-Tique to finish a wider variety of products than the standard conveyORIZED finishing line. The custom furniture lifts were built with the help of a small grant from Minnesota OSHA.

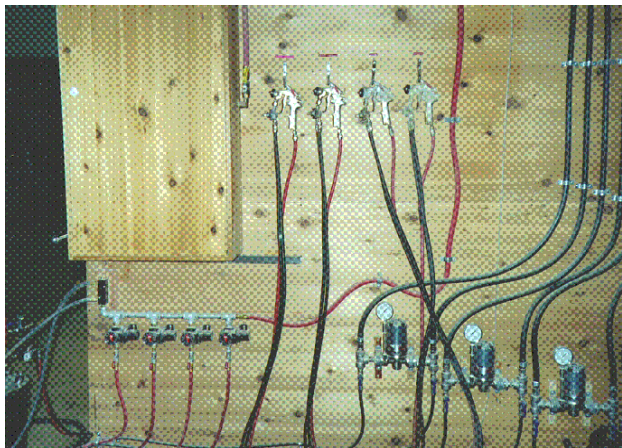


Spray booth

Many spray equipment changes were necessary because Pine-Tique's original system was not compatible with waterborne coatings. Pumps and fluid lines needed to be plastic or stainless steel to be waterborne compatible, and conventional spray guns were replaced with HVLP guns. The spray equipment changes were facilitated by a low-interest loan made available by the Small Business Assistance Program of the Minnesota Pollution Control Agency.

Another operator-friendly feature of the new finishing area at Pine-Tique is in the paint kitchen. Each of four coating pump systems is attached to a lift system, which lifts the pump high enough to allow an empty drum to be easily rolled out and replaced.

Each spray booth is outfitted with four dedicated lines (two different toners, a sealer, and a topcoat, all waterborne) that are on a circulating system and receive their coatings directly from the 55-gallon drums in the paint kitchen. These coating lines are completely independent of each other, allowing operators in both spray booths to spray the same coating simultaneously, if necessary. The waterborne finishing system typically consists of a toner, wiping stain, sealer, and topcoat. Because there are not dedicated lines for the stain colors, they are applied from pressure pots and 5-gallon pumping systems.



Dedicated spray lines

There are no dedicated lines for the solvent-borne coatings because Pine-Tique hopes to continue to decrease the amount they use over time. Smaller quantities of solvent-borne coatings are applied using conventional spray guns from pressure pots. The larger quantities of solvent-borne coatings are applied using conventional spray guns and pumped from 55-gallon drums. All drums and pressure pots are on rollers to facilitate movement between spray booths and the paint kitchen.

Cleaning Operations

Cleaning operations at Pine-Tique are minimal because of the use of dedicated lines. Dedicated lines eliminate the need for flushing between color changes. Line flushing generates a large quantity of wastewater and cleaning solution. Eliminating line flushing dramatically decreases the amount of cleaning solution used and wastewater generated. However, the waterborne stains currently are not on a dedicated line system; Pine-Tique hopes to install dedicated lines for the most popular stain colors in the future to further reduce cleaning.

Pine-Tique buys a cleaning solution from their coating supplier that is formulated specifically for cleaning their waterborne coatings. A typical cleaning cycle consists of two 1-quart rinses of water followed by one 8-ounce rinse of cleaning solution. Only five to six gallons of wastewater is produced per week; any pollutants are so dilute that the wastewater can be sent through the municipal sewer system.

Conversion to Waterborne Coatings

The development period was a two-year process, during which the quality of products finished with the new waterborne coatings was disappointing. The final finish was rougher due to grain raise and lacked the depth of color desired by Pine-Tique. In 1998, the waterborne testing process began to gain speed. A new coating supplier, Van Technologies, provided a waterborne coating system which produced a high-quality finish equivalent to the original solvent-borne system. Van Technologies also reformulated their coatings to meet Pine-Tique's individual needs, a service the previous suppliers did not provide.

Operator training was accomplished mainly through trade magazine articles on waterborne finishing techniques. There was not much of a change because the waterborne coatings are applied by spray guns, as the original solvent-borne system was. The conventional spray guns from the solvent-borne system were replaced with HVLP guns for the waterborne system, but the operators found the differences between the two types to be minimal. There also are differences in the behavior of the coatings during application, but they were identified and resolved fairly quickly by the operators.

Currently, approximately 50 percent of the facility's products are finished with the waterborne system. All new product lines are finished with the waterborne system, but some of the older product lines still are finished with the conventional solvent-borne system to avoid any color-matching problems with vendors' back-stock. Gradually, the older product lines are being converted to the waterborne system, and Pine-Tique hopes that they will eventually convert 80 percent of their production to the waterborne coatings.

Costs

The major expense for Pine-Tique was the purchase and installation of water-compatible equipment. The lines and pumps were replaced with plastic or stainless steel. The spray guns were replaced with HVLP guns. Stainless steel equipment, on

average, was two or three times the cost of the equipment Pine-Tique originally was using. The total capital expenditure for new equipment was \$24,000.

There also was a cost difference in the coatings themselves. The waterborne coatings cost approximately twice as much per gallon as the equivalent solvent-borne coatings. However, because of a higher solids content per gallon than common solvent-borne coatings, the amount of waterborne coating used per board foot of wood is less than the solvent-borne coating. So, the better coverage rate of the waterborne coating offsets part of its higher cost. Since the waterborne finish is more durable (increased scratch and chemical resistance), and provides environmental and workplace health benefits, Pine-Tique feels the improvements outweigh the cost difference.

Emissions

Pine-Tique's standard solvent-borne lacquer contains 5.5 pounds of VOCs per gallon. The new waterborne topcoat contains 2.92 pounds of VOCs per gallon, and the sealer contains only 2.81 pounds of VOCs per gallon. All waterborne products used at Pine-Tique also are no-HAP products. This change in VOC/HAP content dramatically reduced the facility-wide emissions.

In 1995, when an all solvent-borne coating system was in place, Pine-Tique emitted 8,970 pounds of VOCs. Taking production into account, this is equivalent to 0.10 pound of VOC per board foot of furniture produced. In 1998, the VOC emissions were 9,427 pounds. Because of the increase in production, this is equivalent to 0.064 pound of VOC per board foot of furniture produced. From 1995 to 1998, there was a 75 percent increase in production but only a 10 percent increase in VOC emissions.

Customer Feedback

Customer reaction was negative at the beginning of Pine-Tique's conversion to waterborne coatings. In 1996, the finish was rough and lacked the depth of color achieved by the solvent-borne system. However, as the coatings were reformulated, the finish quality improved and the customer complaints ceased. The current waterborne system provides a more durable finish than the solvent-borne system. Pine-Tique is pleased with the continued improvement of the quality of the waterborne coatings that they are applying.